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COMPLIANCE IS MANDATORY

John C. Stennis Space Center
Pressure Vessel and Pressurized System Procedural Requirements

Document History Log

Status/ Change/ Revision	Change Date	Originator/Phone	Description
Basic	December 2008	Son Le 8-3816	Initial Release.

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PREFACE

P.1 PURPOSE

The purpose of this procedural requirement is to define the post-construction requirements for the operation, maintenance, repair and alteration of pressure vessels and pressure systems at Stennis Space Center (SSC) as required in NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S).

P.2 APPLICABILITY

a. This procedural requirement applies to all NASA personnel performing activities at the John C. Stennis Space Center.

b. This procedural requirement applies to contractors and sub-contractors at SSC to the extent specified by their respective contracts.

c. This procedural requirement applies to all ground-based pressure vessels and systems (including vacuum) that are Stennis Space Center owned or used on SSC property, in permanent or temporary configurations, regardless of owner or user.

P.3 AUTHORITY

a. 42 U.S.C. § 2473(c)(1), Section 203(c)(1) of the National Aeronautics and Space Act of 1958, as amended.

b. 29 CFR Part 1910, Occupational Safety and Health Standards.

c. NPD 8710.5, NASA Safety Policy for Pressure Vessels and Pressurized Systems.

P.4 APPLICABLE DOCUMENTS

The following references are applicable to the requirements defined in this directive. All references are assumed to be the latest version unless otherwise specified.

a. NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S).

b. SPLN-1200-0002, Technical Authority Implementation Plan.

c. SPR 8715.1, Safety and Health Procedural Requirements.

d. SSP-8715-0001, John C. Stennis Space Center Safety and Health Handbook.

e. SSTD-8070-0097-TEST, Relief Devices - Inspection and Recertification.

f. SSTD-8070-0124-IDCODES, Identification of Piping Systems and Above-Ground Markers.

g. API RP-580, Risk-based Inspection.

h. NB-23, National Board Inspection Code.

P.5 MEASUREMENT/VERIFICATION

Compliance with requirements cited in this SPR will be measured through unscheduled facility walkdowns, scheduled periodic inspections, and the documentations of nonconformance.

P.6 CANCELLATION

None

Signature on File

Arthur E. Goldman
Director

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CHAPTER 1. ROLES AND RESPONSIBILITIES

1.1 Owner-user

a. An owner-user organization is responsible for developing, documenting, implementing, executing, and assessing pressure vessel inspection systems and inspection procedures that will meet the requirements of NASA-STD-8719.17 and the appropriate National Consensus Codes and Standards (NCS) (see Appendix B).

b. The owner/users shall be responsible for:

1. Appointing a Pressure Systems Manager to be responsible for the pressure vessel program at SSC and direct technical efforts and act as the primary point-of-contact for all technical and re-certification activities.

2. Establishing organization and reporting of structure for inspection personnel.

3. Maintaining inspection and quality assurance procedures.

4. Maintaining documentation and reports of inspection and test results.

5. Following up on corrective actions for inspections and test results.

6. Performing internal audits for compliance with the quality assurance inspection manual.

7. Reviewing and approving drawings, design calculations, and specifications for repairs, alterations, and ratings.

8. Assuring that all jurisdictional requirements for pressure vessel inspection, repairs, alterations, and re-rating are continuously met.

9. Reporting to the authorized pressure vessel inspector any process changes or process upsets that could affect pressure vessel integrity.

10. Establishing training requirements for inspection personnel regarding inspection tools, techniques, and technical knowledge base.

11. Ensuring only certified welders and qualified weld procedures are used for all repairs and alterations.

12. Ensuring only qualified nondestructive examination (NDE) personnel and procedures are utilized.

13. Ensuring only materials conforming to the applicable section of the ASME code are utilized for repairs and alterations.

14. Ensuring all inspection measurement and test equipment are properly maintained and calibrated.

15. Ensuring the works of contracted inspection or repair organizations meet the same inspection requirements as the owner-user organization.

16. Establishing internal auditing requirements for the quality control system for pressure-relieving devices.

1.2 Pressure System Manager

a. A Pressure System Manager shall be appointed by the owner-user.

b. The Pressure System Manager shall:

1. Perform duties as specified in NPD 8710.5, NASA Safety Policy for Pressure Vessels and Pressurized Systems.

2. Create a Pressure System Committee (as specified in SBCC-1150-0010).

3. Approve designs, provide funding forecasts, establish requirements, and provide authority and technical expertise for pressure vessel and pressurized systems in-service inspection and analysis, certification and re-certification activities, modifications, and repairs.

4. Serve as the authority on the interpretation of this document.

1.3 Pressure System Administrator

a. A Pressure System Administrator shall be appointed by the organization having responsibility for oversight of the pressure vessel and pressure system.

b. The Pressure System Administrator shall:

1. Maintain a current inventory and certification status of all ground-based PV/S.

2. Ensure that PV/S transferred from or to SSC is properly documented as to the certification status.

3. Provide and submit the annual SSC Re-certification/Certification Status Report to SSC Central Engineering Files (CEF).

4. Designate a Risk Based Inspection (RBI) Facilitator.

1.4 Pressure System Committee

The Pressure System Committee shall:

a. Assure that the requirements of NASA-STD 8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S). are met.

b. Provide guidance on pressure systems requirements to the Pressure Systems Manager, the users and other appropriate personnel.

c. Make determination if a PV/S is within the scope of NASA-STD 8719.17.

1.5 Pressure System Engineer

a. A Pressure System Engineer shall be appointed by the organization having responsibility for oversight of the pressure vessel and pressure system.

b. The Pressure System Engineer shall:

1. Maintain an overview of pressure systems technology.

2. Participate in re-certification activities.

3. Provide original certification records to the Facilities Engineering Department.

4. Ensure that any temporary vessels brought onto SSC comply with the requirements of this document and the Pressure System Manager is notified.

5. Provide and submit annual Periodic Inspections to SSC Central Engineering File.

6. Provide and submit the Re-certification/Certification Status Report to SSC CEF.

1.6 Office of Safety & Mission Assurance

The SSC Office of S&MA shall:

a. Serve as the S&MA technical authority as defined in SPLN-1200-0002, Technical Authority Implementation Plan.

b. Ensure SSC policy, responsibilities, and requirements for pressure vessels and systems are established and in compliance with this document.

c. Review and approve, if appropriate, deviations and waivers in accordance with compliance documentation(s).

d. Ensure training and certification program for operators of pressure systems.

e. Oversee PV/S Safety Awareness Program to periodically alert all SSC personnel of the proper procedures for working with and around pressure systems.

1.7 PV/S Users

PV/S users shall:

a. Designate a responsible engineer(s) for the pressure system program.

b. Ensure all personnel operating PV/S are trained in pressure system operation and safety.

c. Correct inspection and certification deficiencies.

d. Establish and maintain a configuration management system for each PV/S within their interface.

e. Ensure that all PV/S designs, alterations, modifications, and repairs are in accordance with the appropriate National Consensus Codes and Standards..

f. Mark and tag all pressure system components properly.

g. Ensure changes in a PV/S service is a configuration managed process.

1.8 Pressure Vessel/System Inspector(s)

a. When inspections, repairs, or alterations are being conducted on pressure systems, an Authorized Inspector shall be responsible to the owner-user for determining that the requirements of NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S). and applicable NCS on inspection, examination, and testing are met.

b. The inspector shall be directly involved in the inspection activities. The pressure vessel Authorized Inspector may be assisted in performing visual inspection by other properly trained and qualified individuals, who may or may not be certified vessel inspectors.

1.9 Repair Organization

All repairs and alterations shall be performed in accordance with NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S). and the appropriate NCS.

1.10 RBI Facilitator

a. An RBI Facilitator shall be appointed by the organization having responsibility for oversight of the pressure vessel and pressure system recertification program.

b. The RBI facilitator shall:

1. Collect data and documentation on certification, recertification, repairs, alterations and re-rating of PV/S.

2. Maintain and update the RBI database with data following the certification, recertification, repairs, alterations and re-rating of PV/S.

3. Ensure PV/S inspection and recertification intervals are documented and updated.

4. Ensure the risk analysis for PV/S equipment in Reliability Based Mechanical Integrity (RBMI) is current (refer to Appendix C for the RAC correlation of RBMI 5x5 to IRMA 5x5 and the RAC mapping to NASA STD-8719.17 4x5 matrix.).

CHAPTER 2. REQUIREMENTS

2.1 General Criteria

a. In addition to inspection and re-certification, any pressure system components falling under the scope of NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S) shall be repaired, altered, or re-rated using the requirements set forth by the applicable National Consensus Codes and Standards.

b. Pressurized equipments downstream of k-bottles, where they are not rated for full k-bottles pressure, shall meet the requirements of NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S).

c. Systems provided with pressure measuring devices shall meet the requirement in NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S).

d. Relief valve certification shall be performed per SSTD-8070-0097-TEST, Relief Devices - Inspection and Recertification.

e. Pressure system piping shall be legibly marked, identifying contents, temperature, pressure, and flow direction in accordance with SSTD-8070-0124-IDCODES, Identification of Piping Systems and Above-Ground Markers.

2.2 Pressure System Panels

a. All panels shall have an isolation valve.

b. All inspection plugs, pressure gages, temperature gages, and safety relief valves shall be readily accessible for service and inspection.

c. Panels fed from portable sources (i.e., trailers, k-bottles) shall have supply-hose anchored.

d. All panels shall have, at a minimum, a calibrated primary gauge and pressure relief device.

e. The set pressure of the relief device shall not exceed the Maximum Allowable Working Pressure (MAWP) of the weakest component downstream of the panel.

2.3 Flexible Pneumatic and Cryogenic Hoses

a. All requirements of NASA-STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S). shall be met.

b. Flexible hoses shall be protected from personnel traffic and moving equipment damage.

c. Flexible hoses shall be inspected before each use.

d. A hose found with flat areas, kinks, sharp ends, twists, leaking or damaged fittings, overdue pressure tests, or excessive corrosion or deterioration shall be removed from service.

e. Flexible hoses shall be marked to indicate MAWP and date of last pressure test.

f. Flexible metal hoses for which the working pressure is unknown or cannot be established shall be recertified or be removed from service.

g. Flexible hoses shall not be subjected to pressures greater than the MAWP.

2.4 Test and Inspection

a. Personnel shall be cleared from the area while performing pressure tests above MAWP.

b. Procedures shall be executed to prevent nonessential personnel from entering the area.

c. Adequate venting shall be provided at high points of vessels to prevent collapse during draining of liquids.

2.5 Safety Notes

a. Pressure system operations shall be conducted using written procedures.

b. PV/S shall be considered potentially hazardous until it is established that the system is at ambient pressure.

c. Warning signs shall be posted at entrances to areas where high-pressure operations are performed or where high-pressure gases are stored.

d. Test and storage areas where leakage can present a toxic or flammable hazard to personnel or equipment shall be equipped with gas detectors and audible alarms.

e. Pressure system operations shall be reviewed and approved prior to implementation.

2.6 Risk Based Inspection

In order to meet the requirements of NASA STD-8719.17, NASA Requirements for Ground Based Pressure Vessels and Pressurized Systems (PV/S., SSC has adopted the methodology of API RP-580, Risk-based Inspection.

2.7 Pressure Vessels and Systems

This section describes the procedures for the maintenance of pressure vessels and systems, including those in service, used vessels and systems being put into new service, and those on standby.

2.7.1 Oversight Organizations

The organization having responsibility for oversight of the pressure vessel and pressure system shall:

a Define the pressure systems:

1. The systems shall be defined by means of schematics or other documentations that identifies, describes, and inventories each component and its location.

2. Each Pressure Vessel/System shall be assigned a Risk Assessment Code (RAC). This RAC will be used as part of a Risk Based Inspection Program.

3. Design or fabrication documentations shall be available for review. When necessary, obtaining the missing documentations or generate equivalent documentations.

b. Identify categories of systems and components. Each component within the system shall be identified and placed in one of the following categories:

- Pressure Vessels
- Tanks
- Vacuum Vessels
- Flexible Hose
- Pressure Relief Devices
- Piping and Piping System Components (Should include pipe, pipe fittings, valves, pumps and compressors, and all other pressurized components within the system not singled out in one of the above categories.)

c. Ensure all pressurized equipment to be used at SSC by off-site contractors or subcontractors shall have the concurrence of the Pressure System Manager prior to service.

2.7.2 Maintenance Inspection, Repair and Alteration

a. Maintenance inspection, repair and alteration of pressure vessels shall be performed in accordance with NASA-STD-8719.17 and the appropriate NCS. (See Appendix B)

b. Maintenance inspection, repair and alteration of piping systems shall be performed in accordance with NASA-STD-8719.17 and the appropriate NCS. (See Appendix B)

c. Maintenance inspection, repair and alteration of tanks shall be performed in accordance with NASA-STD-8719.17 and the appropriate NCS. (See Appendix B)

d. Maintenance inspection, repair and alteration of pressure relief devices shall be performed per National Board NB-23.

e. Maintenance inspection, repair and alteration of other components not specifically listed shall be performed per manufacturer's guidelines or be based on good engineering practice.

f. Maintenance inspection, repair and alteration of any other components not meeting the requirements above shall be performed using an appropriate NCS as determined by the Pressure System Committee.

g. Following any repair or alteration, a Certificate of Completion shall be generated and filed in CEF. As a minimum, the Certificate of Completion should contain the following information: descriptions of the discrepant items, the scope of the repair/alteration, the final NDE results and all supporting Work Authorizing Documents. If available, information regarding the welding procedure(s) used, the welder qualification and any other relevant documents.

h. The Certificate of Completion shall be prepared by the organization that actually performed the repair/alteration.

i. When the repair/alteration is performed by an off-site contractor or subcontractor, the organization responsible for the off-site contractor or subcontractor shall prepare the Certification of Completion.

2.7.3 Certification and Re-certification

Certification and re-certification of PV/S shall be performed in accordance with NASA-STD-8719.17.

2.7.4 Documentation and Evaluations

a. The inspections and tests shall be documented in the Reliability Based Mechanical Integrity (RBMI) database and in CEF.

b. The inspection and test results shall be reviewed to determine if the system is qualified for recertification at the intended service.

c. If the system is adequate for recertification, the recertification file shall be completed and a periodic in-service inspection and recertification program documented for continued use. If

the system cannot be recertified, there are three alternative actions that can be taken: de-rate, repair, or perform an engineering analysis to determine a new basis for recertification.

1. De-rate the System - The system may be de-rated to less severe service conditions on a permanent or temporary basis. Temporary de-rating will allow the system to be operated at a safe service level during the time it takes to make modifications or to develop an engineering rationale sufficient to certify the system for the original service. Completion of inspections and tests may be accomplished to certify the de-rated system for the lower service.

2. Repair the System or Components - The system may be repaired and returned to a condition that can be recertified. Following the repairs, the pertinent inspections and tests should be performed and documented.

3. Perform Engineering Analysis - An engineering evaluation may be performed to determine the service level or operating condition for which the system can be certified. Such engineering evaluations may employ tools such as API RP-579, Fitness for Service.

d. Recommendations concerning the information shall be recorded and the appropriate documentation be maintained.

e. The recertified equipment shall be marked or tagged to indicate date of recertification and service level and it should be indexed to the recertification data file.

f. A periodic inspection program shall be established. Periodic inspection is necessary to ensure a system maintains its certification status. The plan should provide surveillance over critical areas to provide confidence in structural integrity between recertification periods.

g. As a minimum, the results of the periodic inspection shall be reviewed by the Pressure Vessel Engineer and the Authorized Inspector.

h. All removal, installation, or relocation of a PV/S at SSC shall be documented on an Engineering Modification Instruction (EMI) package.

i. The Pressure Vessel Committee shall be notified of the intent to remove any PV/S from SSC or to bring in any PV/S onto SSC.

j. Out-of –Service PV/S to be returned to service shall follow the requirements of NASA-STD-8719.17.

APPENDIX A. ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

A.1 Acronyms and Abbreviations

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
B&PVC	Boiler and Pressure Vessel Code
CEF	Central Engineering Files
CFR	Code of Federal Regulations
EMI	Engineering Modification Instruction
MAWP	Maximum Allowable Working Pressure
NCS	National Consensus Codes and Standards
NDE	Non-destructive Examination
OSHA	Occupational Safety and Health Administration
PV/S	Pressure Vessels and Systems
RAC	Risk Assessment Code
RBI	Risk Based Inspection
RBMI	Reliability Based Mechanical Integrity
S&MA	Safety and Mission Assurance
SPR	Stennis Space Center Procedural Requirements
SSC	John C. Stennis Space Center
STD	Standard
VPP	Voluntary Protection Program

A.2 Definitions

(1) Acoustic Emission Testing – A phenomena whereby transient elastic waves are generated by the rapid release of energy from localized sources within a material or the transient waves so generated. In acoustic emission testing, these waves are captured and represented as waveforms for evaluation.

(2) Alteration of piping system - A physical change in any component or a re-rating that has design implications that affect the pressure containing capability or flexibility of a piping system beyond the scope of its design. The following are not considered alterations: comparable or duplicate replacement, the addition of any reinforced branch connection equal to or less than the size of the existing reinforced branch connections, and the addition of branch connections not requiring reinforcement. All alterations must also be authorized by the Authorized Inspector and an engineer before the work is started.

(3) Alteration of pressure vessel - A physical change in any component or a re-rating that has design implications that affect the pressure containing capability or flexibility of a pressure vessel beyond the scope of its design. The following are not considered alterations: any comparable or duplicate replacement, the addition of any reinforced nozzle less than or equal to the size of existing reinforced nozzles, and the addition of nozzles not requiring reinforcement. All alterations must also be authorized by the Authorized Inspector and an engineer before the work is started.

(4) Authorized Inspection Agency – Any one of the following:

a) The inspection organization of the jurisdiction in which the pressure vessel is used.
b) The inspection organization of insurance companies that is licensed or registered to write and actually does write pressure vessel insurance.
c) The inspection organization of an owner or user of pressure vessels who maintains an inspection organization for his equipment only and not for vessels intended for sale or resale.
d) An independent organization or individual that is under contract to and under the direction of an owner-user's and that is recognized or otherwise not prohibited by the jurisdiction in which the pressure vessel is used. The owner-user's inspection program shall provide the controls that are necessary when contract inspectors are used.

(5) Authorized Inspector - An employee of an authorized inspection agency who is qualified and certified to perform inspection under an appropriate NCS (for example, API-510, API-570 or NB-23). An NDE Examiner is not required to be an authorized inspector.

(6) Certification - The documented status that qualifies a vessel or system to operate in the service for which it is intended.

(7) De-rated Vessel or System - A vessel or system that has been judged to be unsafe, unsuitable, or unnecessary for continued operation at its original design pressure and/or temperature limits, and has been re-certified to operate at a lesser pressure and/or temperature limit range.

(8) Design Pressure - The pressure along with the design temperature used to determine the minimum permissible thickness or physical characteristic of each vessel component as determined by the vessel design rules. The design pressure is selected by the user to provide a suitable margin above the most severe pressure expected during normal operation at a coincident temperature. It is the pressure specified on the purchase order. This pressure may be used in place of the MAWP in all cases where the MAWP has not been established. The design pressure is equal to or less than the MAWP. In piping system, the design pressure is the same as the MAWP.

(9) Design Temperature - The metal temperature used in the design of a vessel for determining the minimum required thickness of the components. Also, the metal temperature used for selecting the maximum allowable stress for the materials used in the vessel.

(10) Efficiency of a Welded Joint - A numerical (decimal) quantity expressed as a multiplier of the allowable stress value used in the design of a joint.

(11) Engineering Modification Instructions (EMI): A is a multiform change control document that provides total control of changes to the Site-wide Operation and Repair Documentation (SORD) baseline drawings. EMIs are generated when the request is made to change the baseline configuration with proper documentation.

(12) Fitness-for-service Assessment – A methodology whereby flaws and conditions contained within a structure are assessed in order to determine the integrity of the equipment for continued service.

(13) Flight PV/S: An assembly of components under pressure, including vessels, piping, valves, relief devices, pumps, expansion joints, gages, etc., that are fabricated in accordance with program requirements specifically for use in aircraft or spacecraft."

(14) Ground-based PV/S: All PV/S, including PV/S based on barges, ships, or other transport vehicles, not specifically excluded in 4.2. Flight weight PV/S used for their intended purpose aboard active air or space craft, even though on the ground, are not included in this definition, but flight weight PV/S converted to ground use are included.

(15) Hydrostatic Test - A test performed on a pressure vessel or system in which the vessel or system is filled with a liquid (usually water) and pressurized to a designated level in a manner prescribed in the applicable code.

(16) In-service Inspection - Inspection performed after a system has been initially put into service. The system may have to be inoperative during such inspection.

(17) Maximum Allowable Stress Value - The maximum unit stress permissible for a specific material used in the appropriate design formulas.

(18) Maximum Allowable Working Pressure (MAWP) - The maximum gauge pressure permissible at the top of a completed vessel in its normal operating position at the designated coincident temperature specified for that pressure. It is the least of the values for the internal or external pressure as determined by the vessel design rules for each element of the vessel using actual nominal thickness, exclusive of additional metal thickness allowed for corrosion and loadings other than pressure. The MAWP is the basis for the pressure setting of the relief devices that protect the vessel. The MAWP is normally greater than the design pressure (as specified on the purchase order), but must be equal the design pressure when the design rules are used only to calculate the minimum thickness for each element and calculations are not made to determine the value of the MAWP. For piping system, it is the same as the design pressure (as defined in ASME 31.3).

(19) National Consensus Codes & Standards (NCS): Baseline national consensus codes and standards and regulatory documents from which requirements are derived and upon which certification and recertification are based consistent with NPD 8710.5.

(20) NDE Examiner – A person who assists the authorized inspector by performing specific NDE on the pressure system, but does not evaluate the results of those examinations in accordance with the appropriate NCS.

(21) Operating or Working Temperature - The metal temperature that will be maintained in the part of the vessel under consideration during normal operation.

(22) Operating Pressure - The pressure at the top of a vessel at which it normally operates. It shall not exceed the MAWP.

(23) Piping Circuit - A section of piping that has all points exposed to an environment of similar corrosivity and that is of similar design conditions and construction material.

(24) Piping System - An assembly of interconnected piping that is subject to the same set or sets of design conditions and is used to convey, distribute, mix, separate, discharge, meter, control or snub fluid flows.

(25) Pneumatic Test - A test performed on a pressure vessel or system in which air or gas is introduced and pressurized to a designated level in a manner prescribed in the applicable code.

(26) Pressure System - An assembly of components under pressure, including vessels, piping, valves, relief devices, pumps, expansion joints, gages, etc.

(27) Pressure Systems Engineer - One or more persons or organizations who are knowledgeable and experienced in the engineering disciplines associated with evaluating mechanical and material characteristics which affect the integrity and reliability of the pressure systems. The pressure system engineer should be regarded as a composite of all entities needed to properly assess the technical requirements.

(28) Pressure Test – tests used to verify vessel integrity after fabrication or new constructions or to verify leak tightness after repairs or alterations in accordance with NASA-STD-8719.17 and the appropriate NCS.

(29) Pressure Vessel - Any vessel used for the storage or handling of gas or liquid under positive pressure. Included are components of systems, such as, heat exchanger shells and drying towers and other shell structures for which the rules of the ASME Code, Section VIII, would apply.

(30) Proof Test - A pressure test performed to establish the MAWP of a vessel, system, or component thereof: (1) when the strength cannot be computed with a satisfactory assurance of accuracy, (2) when the thickness cannot be determined by means of the design rule of the applicable code or standard, or (3) when the critical flaw size to cause failure at the certified pressure cannot be identified by other nondestructive test methods. The methodology for performing a proof test to establish MAWP is outlined in ASME Section VIII.

(31) Re-certification - The procedure by which a previously certified vessel or system, by appropriate tests, inspections, examinations, and documentation, is qualified to continue or be returned to operations at the design pressure.

(32) Re-certification Period - The period of time between re-certification when a certified status is maintained through documented periodic examinations and inspections to determine vessel or system condition (time between major inspections).

(33) Repair of piping system – The work necessary to restore a piping system to a condition suitable for safe operation at the design conditions. If any repair changes the design temperature or pressure, the requirements for re-rating shall be satisfied. Any welding, cutting, or grinding operation on a pressure-containing piping component not specifically considered an alteration is considered a repair. All repairs must also be authorized by the Authorized Inspector before the work is started.

(34) Repair of Pressure Vessels - The work necessary to restore a pressure vessel to a condition suitable for safe operation at the design conditions. If any repair changes the

design temperature or pressure, the requirements for re-rating shall be satisfied. A repair can be the addition or replacement of pressure and non-pressure parts that do not change the rating of the vessel. All repairs must also be authorized by the Authorized Inspector before the work is started.

(35) Re-rating of Piping System – A change in either or both the design temperature or the MAWP of a piping system. A re-rating may consist of an increase, a decrease, or a combination of both. De-rating below original design conditions can be used to provide increased corrosion allowance.

(36) Re-rating of Pressure Vessel - A change in either or both the design temperature or the MAWP of a pressure vessel. A re-rating may consist of an increase, a decrease, or a combination of both. De-rating below original design conditions can be used to provide increased corrosion allowance. When a re-rating is conducted in which the MAWP or temperature is increased or the minimum temperature is decreased so that additional mechanical tests are required, it shall be considered an alteration.

(37) Risk Based Inspection (RBI) – A risk assessment and management process that is focused on loss of containment of pressurized equipment due to material deterioration. These risks are managed primarily through equipment inspection.

(38) SORD - The SORD system is based on a family tree that defines the drawing numbering system at SSC. Each drawing and specification is assigned a specific location by Central Engineering Files on the tree for ease of traceability.

(39) Tank - Any vessel used for the storage or handling of liquids where the internal pressure is only a function of the liquid head or a combination of liquid head and vapor pressure.

(40) Vacuum System - An assembly of components under vacuum, including vessels, piping, valves, relief devices, pumps, expansion joints, gages, etc.

APPENDIX B. MATRIX OF RESPONSIBILITIES

Responsibility	Responsible Party
Inclusion of Excluded or Optional pressure systems in the recertification program	Owner/User or Representative
Developing, documenting, implementing, executing and assessing PV/S systems and procedures	Owner/User or Representative
Option of selecting RBI assessments	Owner/User or Representative
Maintenance of Permanent/Progressive Records	Owner/User or Representative
Activities including Design, Analysis or Evaluation of Pressure System	Pressure System Engineer / Piping Engineer
Provide materials, equipment, quality control, and workmanship necessary to maintain and repair pressure system	Repair Organization
Repair/Alterations authorizations and approvals	Authorized Inspector (all repairs and alterations) Pressure System Engineer (alterations of ASME Div 1 and Div 2 vessels; repairs of ASME Div 2 vessels)
Maintenance inspections, repairs, alterations of pressure systems	Authorized Inspectors ASME Coded Vessels: National Board Inspector, NB-23 Non-ASME Vessels: API-510 Piping: API-570 Atmospheric Storage Tank: API-653 (for API-650 tanks) Relief Valves: National Board VR
Determining the need for Re-rating of Pressure Systems	Pressure System Engineer / Piping Engineer
Pressure Testing after repair (deemed practical	Authorized Inspector

Responsibility	Responsible Party
or necessary)	ASME Coded Vessels: National Board Inspector, NB-23 Non-Coded Vessels: API-510 Piping: API-570 Atmospheric Storage Tank: API-653 (for API-650 tanks)
Maintenance of Permanent/Progressive records	Owner/User or Representative

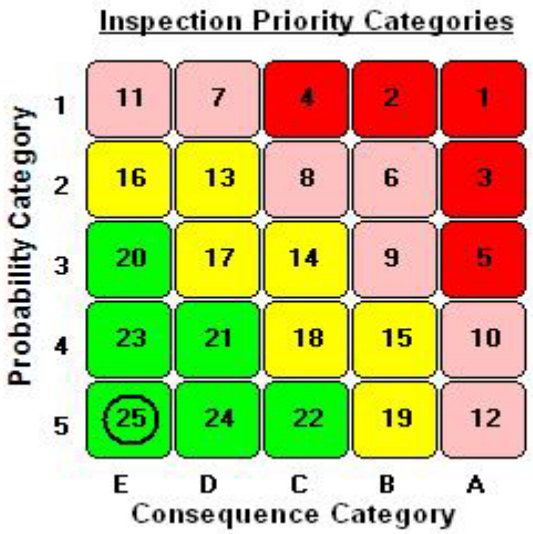
APPENDIX C. RAC CORRELATION AND MAPPING

C.1 NASA STD-8719.17 Risk Matrix

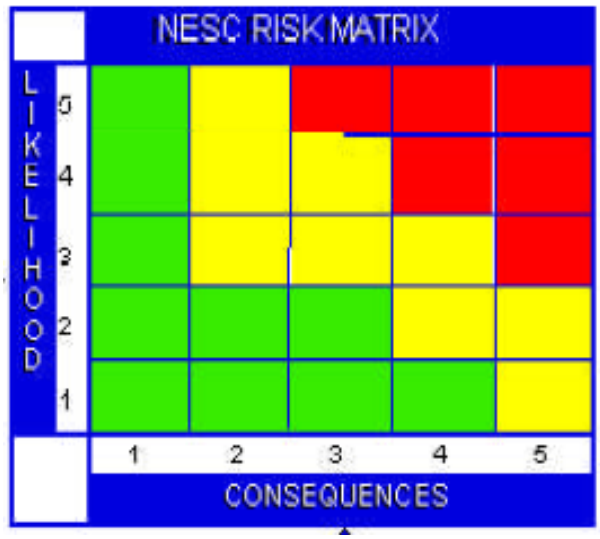
Table 1. RAC Determination

	A Frequent	B Probable	C Occasional	D Remote	E Improbable
I Catastrophic	1	1	2	3	4
II Critical	1	2	3	4	5
III Moderate	2	3	4	5	6
IV Negligible	3	4	5	6	7

C.2 RBMI Risk matrix



C.3 IRMA Risk Matrix



C.4 RAC CONVERSION

RAC MAPPING
NASA IRMA AND RBMI AND NASA STD-8719.17

			CONSEQUENCE				
			Minor	Significant	Serious	Very Serious	Catastrophic
		IRMA / RBMI	1 / E	2 / D	3 / C	4 / B	5 / A
PROBABILITY (LIKELYHOOD)	Very High	5 / 1	7	3	2	1	1
	High	4 / 2	7	4	3	2	1
	Moderate	3 / 3	7	5	4	3	2
	Low	2 / 4	7	6	5	4	3
	Very Low	1 / 5	7	7	6	5	4

Note: RBMI Consequence breakdown– A > $ 5,000,000 ; B > $ 500,000 to $ 5,000,000; C > $ 50, 000 to $ 4,999,999; D > $ 5,000 to $ 49,999; E < $ 5,000

Rationale: NASA STD-8719.17 uses a 5x4 matrix to rank risk from a RAC 1 to a RAC 7, with a RAC 1 being the most severe (see C.1). Stennis Space Center is adopting an IRMA 5x5 matrix that do not use a single number risk rank (see C.3). Likewise, the RBMI risk matrix is also a 5x5 matrix, but the scoring for probability x consequence is different (See C.2). Therefore, it is necessary to map the RAC result from IRMA to that of STD-8719.17.
NASA STD-8719.17 requires that variance(s) shall be process for all pressure system components with RAC 1,2 or 3.

The mapping is accomplished by truncating Column “1”, the lowest risk column, from IRMA and setting the value of that colum to a RAC 7 (see C.1). By doing so, IRMA is resolved into a 5x4 matrix, which can now be mapped 1-to-1 to the RAC ranking of STD 8719.17.

C.5 Quick Guide

RAC Result		
RBMI	IRMA	NASA STD-8719.17
5,E	1,1	7
4,E	2,1	7
3,E	3,1	7
2,E	4,1	7
1,E	5,1	7
5,D	1,2	7
4,D	2,2	6
3,D	3,2	5
2,D	4,2	4
1,D	5,2	3
5,C	1,3	6
4,C	2,3	5
3,C	3,3	4
2,C	4,3	3
1,C	5,3	2
5,B	1,4	5
4,B	2,4	4
3,B	3,4	3
2,B	4,4	2
1,B	5,4	1
5,A	1,5	4
4,A	2,5	3
3,A	3,5	2
2,A	4,5	1
1,A	5,5	1

APPENDIX D. REFERENCES

1. NB-23, National Board Inspection Code

2. API-510, Pressure Vessel Inspection Code: Maintenance, Inspection, Rating, Repair, and Alteration

3. API-570, Inspection, Repair, Alteration, and Re-rating of In-Service Piping Systems

4. API RP-579, Fitness for Service

5. API RP-580, Risk-Based Inspection

6. ASME Boiler and Pressure Vessel Code (B&PVC)

7. ASME B31, Piping Codes